

Claims

- [c1] A two component coating composition for preventing corrosion of a metallic substrate, the composition comprising:
- a) a film-forming component comprising a film-forming polymer and a crosslinking agent, wherein the film-forming polymer has functional groups selected from the group consisting of active hydrogen containing groups, epoxide groups, and mixtures thereof, and the crosslinking agent have functional groups selected from the group consisting of isocyanate groups and amine groups,
 - b) a corrosion protection component consisting essentially of compounds selected from the group consisting of zinc oxide, zinc phosphate, basic zinc phosphate, zinc nitrophosphthalate, zinc molybdate, basic zinc phosphate hydrate, basic zinc molybdate, zinc benzoate and zinc salt of an organic nitro compound such as those sold under the trademark Heucorin RZ, calcium molybdate, calcium metaborate, barium metaborate, calcium strontium phosphosilicate, aluminum triphosphate, aluminum zinc phosphate, and zinc calcium aluminum strontium polyphosphate silicate and strontium aluminum polyphosphate and mixtures thereof, and
 - c) a component comprising (I) a first compound having an acid number of from 70 to 120mg KOH/g, a hydroxyl number of from 200 to 400mg KOH/g, a number average molecular weight of from 150 to 3000, and which is the reaction product of (a) at least one difunctional carboxylic acid, (b) at least one trifunctional polyol, (c) at least one chain stopper, and (d) phosphoric acid, and (II) a second compound comprising one or more carboxy phosphate esters having the formula: $(R-O)_x-P(O)-(OM)_{3-x}$ wherein M is hydrogen, metal or ammonium, x is a number from 0 to 3, and R is a saturated or unsaturated C_5-C_{40} aliphatic group in which one or more of the aliphatic carbon atoms can be substituted or replaced with a halogen atom (such as fluorine or chlorine), a C_1-C_6 alkyl group, a C_1-C_6 alkoxy group, a C_6-C_{10} aromatic hydrocarbon group, preferably phenyl or naphthyl, or a C_6-C_{10} aromatic hydrocarbon group that is substituted with one or more (preferably 1 to 3) C_1-C_6 alkyl groups or $-COOR^1$ groups wherein R^1 is H, metal, ammonium, C_1-C_6 alkyl, or C_6-C_{10} aryl, or mixtures thereof,

wherein said coating demonstrates at least a 20% reduction in salt spray corrosion over the same coating without components (b) and (c).

- [c2] A composition according to claim 1, wherein corrosion protection component (b) is present in an amount between 0.1 and 20% by weight, based on total coating composition weight.
- [c3] A composition according to claim 1, wherein the corrosion protection component (b) is selected from the group consisting of zinc calcium aluminum strontium polyphosphate, strontium aluminum polyphosphate silicate and mixtures thereof.
- [c4] A composition according to claim 3, wherein the pigments are present in a mixture in a ratio of between 70:30 and 30:70 of zinc calcium aluminum strontium polyphosphate to strontium aluminum polyphosphate silicate, respectively.
- [c5] A composition according to claim 1 wherein second compound (II) has an acid number of from 50 to 200 mg KOH/g, a hydroxyl number of from 100 to 250 mg KOH/g, a number average molecular weight of from 600 to 1200 and is the reaction product of (a) at least one difunctional polyol, (b) phosphoric acid, and (c) at least one trifunctional carboxylic acid.
- [c6] A composition according to claim 1 wherein compound (I) comprises the reaction product of components (a), (b), (c), and (d) reacted in a molar ratio of from 4.2: 4.9:0.01:0.0005 to 5.1:5.6:0.7:0.005.
- [c7] A composition according to claim 1 wherein compound (I) comprises an acid number of from 70 to 100 mg KOH/g, a hydroxyl number of from 300 to 400 mg KOH/g, a number average molecular weight of from 400 to 600.
- [c8] A composition according to claim 1 comprising from 50 to 80 % by weight of compound (I) and from 20 to 50 % by weight of compound (II), based on the total weight of the mixture of compound (I) and compound (II).
- [c9] A composition as claimed in claim 5 comprising from 60 to 75% by weight of compound (I) and from 25 to 40 % by weight of compound (II), based on the

total weight of the mixture of compound (I) and compound (II).

- [c10] A composition as claimed in claim 1 wherein the cured coating composition demonstrates
- the at least one difunctional carboxylic acid (Ia) is selected from the group consisting of adipic acid, azeleic acid, fumaric acid, phthalic acid, sebacic acid, maleic acid, succinic acid, isophthalic acid, tetrahydrophthalic acid, hexahydrophthalic acid, dimer fatty acids, itaconic acid, glutaric acid, cyclohexanedicarboxylic acid, and mixtures thereof, the at least one trifunctional polyol (Ib) is selected from the group consisting of trimethylolpropane, trimethylol ethane, glycerin, 1,2,4-butanetriol, and mixtures thereof, and
- the at least one chain stopper (Ic) is selected from the group consisting of para-t-butyl benzoic acid, benzoic acid, salicylic acid, 2-ethylhexanoic acid, pelargonic acid, isononanoic acid, C₁₈ fatty acids, stearic acid, lauric acid, palmitic acid, and mixtures thereof.
- [c11] A composition as claimed in claim 5 wherein the at least one difunctional polyol (IIa) is selected from the group consisting of neopentanediol, ethylene glycol, diethylene glycol, propylene glycol, dipropylene glycol, hydrogenated bisphenol A, 1,6-hexanediol, hydroxypivalylhydroxypivalate, cyclohexanedimethanol, 1,4-butanediol, 2-ethyl-1,3-hexandiol, 2,2,4-trimethyl-1,3-pentandiol, 2-ethyl-2-butyl-1,3-propanediol, 2-methyl-1,3-propanediol, and mixtures thereof, and the at least one trifunctional carboxylic acid (IIc) is selected from the group consisting of trimellitic acid, 1,3,5-benzenetricarboxylic acid, citric acid, , and mixtures thereof.
- [c12] A composition as claimed in claim 11 wherein the at least one difunctional carboxylic acid (Ia) is adipic acid, the at least one trifunctional polyol (Ib) is trimethylolpropane and the at least one chain stopper (Ic) is para-t-butyl benzoic acid.
- [c13] A composition as claimed in claim 11 wherein the at least one difunctional polyol (IIa) is neopentanediol and the at least one trifunctional carboxylic acid (IIc) is trimellitic acid.

- [c14] A composition as claimed in claim 11 comprising from 0.10 to 1.00 % by weight of the mixture of compounds (I) and (II), based on the total nonvolatile weight of the coating composition.
- [c15] A composition as claimed in claim 1 wherein the film forming binder is comprised of an acrylic resin and an isocyanate functional crosslinking agent.
- [c16] A composition as claimed in claim 1 which is a primer composition.
- [c17] A composition as claimed in claim 1 wherein the cured coating on a substrate demonstrates improved corrosion resistance in comparison to a coating.
- [c18] A method of improving corrosion resistance in a multilayer coating system, comprising
 applying a primer coating composition directly to a metal substrate, the primer coating composition comprising:
 a) a film-forming component comprising a film-forming polymer and a crosslinking agent, wherein the film-forming polymer has functional groups selected from the group consisting of active hydrogen containing groups, epoxide groups, and mixtures thereof, and the crosslinking agent have functional groups selected from the group consisting of isocyanate groups and amine groups, and
 b) a corrosion protection component consisting essentially of compounds selected from the group consisting of zinc oxide, zinc phosphate, basic zinc phosphate, zinc nitrophosphthalate, zinc molybdate, basic zinc phosphate hydrate, basic zinc molybdate, zinc benzoate and zinc salt of an organic nitro compound such as those sold under the trademark Heucorin RZ, calcium molybdate, calcium metaborate, barium metaborate, calcium strontium phosphosilicate, aluminum triphosphate, aluminum zinc phosphate, and zinc calcium aluminum strontium polyphosphate silicate and strontium aluminum polyphosphate, calcium aluminum strontium polyphosphate silicate hydrate, a modified strontium aluminum polyphosphate hydrate, (2-benzothiozolythio)-succinic acid amine salt and mixtures thereof, present in the composition in an amount effective to prevent corrosion of the substrate, and
 c) a composition comprising (I) a first compound having an acid number of from

70 to 120mg KOH/g, a hydroxyl number of from 200 to 400mg KOH/g, a number average molecular weight of from 150 to 3000, and which is the reaction product of (a) at least one difunctional carboxylic acid, (b) at least one trifunctional polyol, (c) at least one chain stopper, and (d) phosphoric acid, and (II) a second compound comprising one or more carboxy phosphate esters having the formula: $(R-O)_x-P(O)-(OM)_{3-x}$ wherein M is hydrogen, metal or ammonium, x is a number from 0 to 3, and R is a saturated or unsaturated C_5-C_{40} aliphatic group in which one or more of the aliphatic carbon atoms can be substituted or replaced with a halogen atom (such as fluorine or chlorine), a C_1-C_6 alkyl group, a C_1-C_6 alkoxy group, a C_6-C_{10} aromatic hydrocarbon group, preferably phenyl or naphthyl, or a C_6-C_{10} aromatic hydrocarbon group that is substituted with one or more (preferably 1 to 3) C_1-C_6 alkyl groups or $-COOR^1$ groups wherein R^1 is H, metal, ammonium, C_1-C_6 alkyl, or C_6-C_{10} aryl, or mixtures thereof, curing the coating to provide a primed metallic substrate, and applying to the primed metallic substrate one or more additional coating compositions, and curing the one or more additional coating compositions to provide a cured multilayer coating system, wherein said coating system demonstrates at least a 20% reduction in salt spray corrosion over the same coating without components (b) and (c).